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R CMa — A NEW PULSATING ECLIPSING BINARY STAR

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While studying the pulsating components in eclipsing binaries, one can determine the precise masses and radii with the accuracy of 10^{-2}. It is the significant advantage for selection and fine tuning of the theoretical models to the observed pulsational spectra in asteroseismology. Up to the present, the number of known eclipsing binaries with one pulsating component is limited and these stars are not studied well. There are many intriguing questions about the pulsational properties of the binaries' components at different stages of mass transfer, about the number and the range of the excited modes, about the role of tidal effects in the mode excitation and selection, about the stability of frequencies and amplitudes of modes.

According to strategy of Central Asian Network (CAN) (Mkrtichian et al. 1998), we started a project on search for and study of new eclipsing binaries with pulsating components. In this paper we present our first discovery of δ Scuti-type variability of the primary component of semidetached Algol-type eclipsing binary star R CMa. Having F0 V spectral class, the primary component is situated inside the instability strip of the δ Scuti stars. The spectral type of the secondary star is K1 IV.

For the search for pulsational light variations we used the published blue filter data, which were obtained during 1955–1956 on the 36-inch Steward reflector in Tucson (Koch, 1960). The reduction procedure was as follows: We selected out-of-eclipse parts of light curves and subtracted their slow orbital light variations. Then we analysed the residual data for nights with good photometric quality using DFT-code and the routine for sine-wave approximation of light curves and precise estimations of amplitudes and phases (Andronov 1994).

The frequency spectra (see Fig. 1) for the majority of the nights of R CMa show the main periodic variability at frequency about 21 c/d (68 min). The amplitude varies from night to night, what may be an indication of the close multiperiodicity. Fig. 2 shows the frequency spectrum for the B filter data of merged nights, the resulting frequency of pulsations is 21.21 c/d (with the uncertainty ± 1 c/d due to spectral window function). The mean semi-amplitude obtained on nights JD 2435449, JD 2435453, JD 2435458, JD 2435508, JD 2435524, JD 2435528, JD 2435531 and JD 2435536 is 4.4 ± 0.7 mmag. Fig. 3 shows the B-filter pulsational light curve folded with the frequency 21.21 c/d. Koch (1960) used A1 V-type comparison star BD -15° 1734 for his observations. Due to it's spectral type, it is situated outside the borders of the δ Scuti instability strip. Therefore, the light variability found out in differential magnitude variations with high probability is related to R CMa.

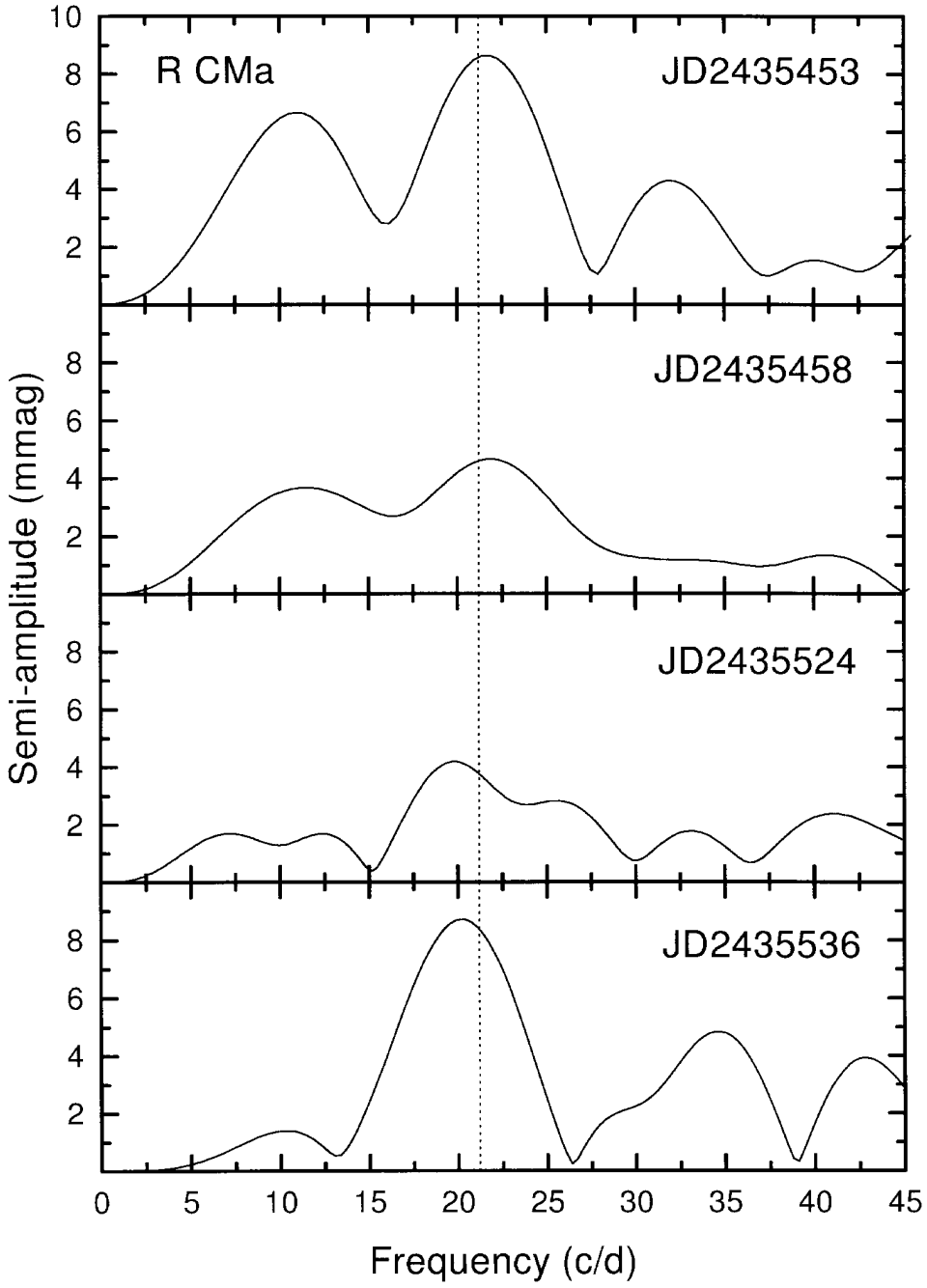

Figure 1. Amplitude spectra of residual data. The dotted line shows the location of frequency 21.21 c/d where pulsations are evident.

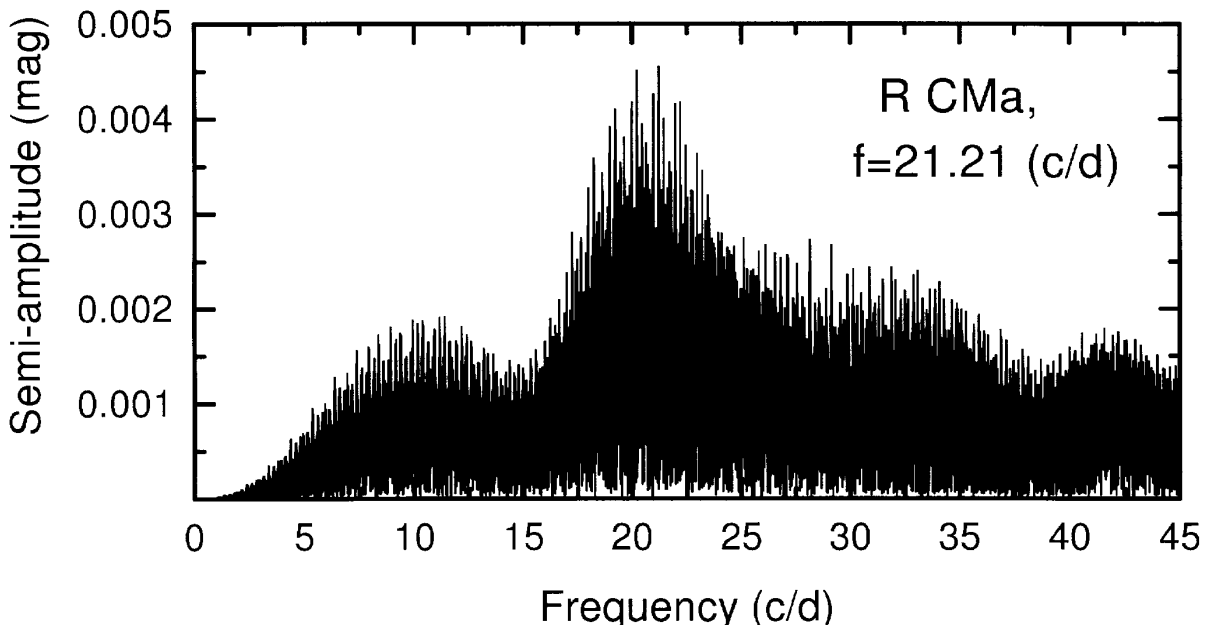

Figure 2. Amplitude spectrum of merged data.

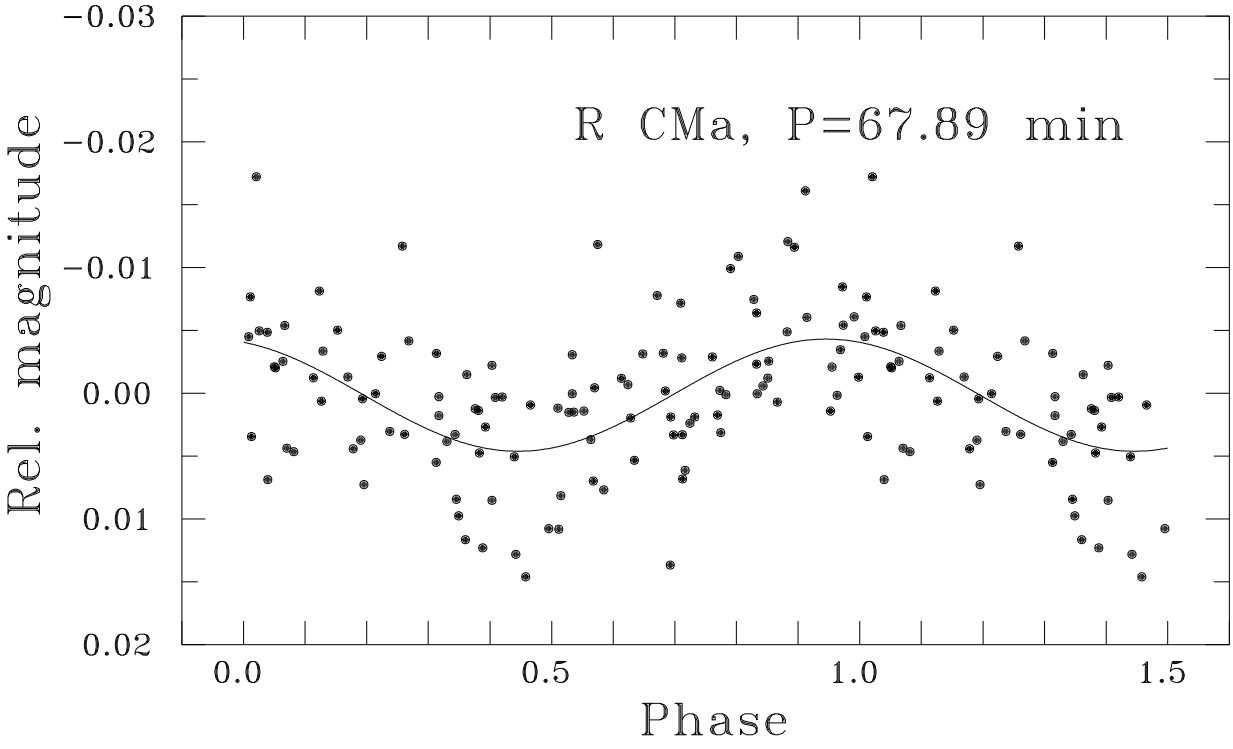

Figure 3. B filter phase curve folded with the period of 67.89 minutes.

This is the first discovery of pulsating δ Scuti-type component in eclipsing binaries obtained during our survey. Further photometry of this object will be acquired in the near future.

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